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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/619,922	07/15/2003	Bing Ji	06437 USA	7155
23543 7590 08/21/2007 AIR PRODUCTS AND CHEMICALS, INC. PATENT DEPARTMENT 7201 HAMILTON BOULEVARD ALLENTOWN, PA 181951501			EXAMINER UMEZ ERONINI, LYNETTE T	
			ART UNIT 1765	PAPER NUMBER
			MAIL DATE 08/21/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/619,922	Applicant(s) JI ET AL.	
	Examiner Lynette T. Umez-Eronini	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 August 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10, 17 and 27-29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10, 17 and 27-29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 May 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>7/27/2007</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Request for Continued Examination

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114 to consider IDS filed 7/27/2007. Applicant's submission filed on 7/27/2007 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Art Unit: 1765

4. Claims 1, 3, 5, 6, 8, 17, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shibata et al. (2003/0079757 A1).

Shibata teach a fluorinated cleaning gas that contains a fluorocompounds such as CF_3OF (same as fluoroxytrifluoromethane) and perfluorocarbons such as CF_4 , C_2F_2 , C_4F_{10} , and C_5F_{12} , which can be used individually or in combination. Another gas such as He, Ne, Ar, or O_2 can be mixed with the fluorinated cleaning gas [0078-0088]. The aforementioned reads on,

A mixture, the mixture comprising:

a fluorocarbon; and

a fluorine-containing oxidizer selected from the group consisting of fluoroxytrifluoromethane, bis-trifluoromethyl-trioxide, fluoro-trifluoromethyl-trioxide, fluoroformyl trifluoromethyl-trioxide, and combinations thereof, **in claim 1**;

wherein the inert diluent gas is at least one selected from the group consisting of argon, neon, xenon, helium, nitrogen, krypton, and combinations thereof, **in claim 3**

wherein the fluorocarbon is at least one selected from the group consisting of perfluorocarbon, hydrofluorocarbon, oxyhydrofluorocarbon, oxyfluorocarbon, and combinations thereof, **in claim 5**;

wherein the fluorocarbon is at least one perfluorocarbon selected from the group consisting of tetrafluoromethane, trifluoromethane, octafluorocyclobutane, octafluorocyclopentene, hexafluoro-1,3-butadiene, and combinations, **in claim 6**;

wherein the fluorocarbon is at least one hydrofluorocarbon, **in claim 8**; and

wherein the dielectric material is at least one selected from the group consisting of silicon, silicon-containing compositions, silicon dioxide, undoped silicon glass, doped silica glass, silicon and nitrogen containing materials, organosilicate glass, organofluoro-silicate glass, low dielectric constant materials, polymeric materials, porous low dielectric constant materials, and combinations thereof, **in claim 17.**

Shibata differs in failing to teach a mixture for etching a dielectric material in a layered substrate, **in claim 1;** and

a mixture for etching a dielectric material in a layered substrate comprising: a fluorocarbon and a fluorotrioxide, **in claim 20.**

Since Shibata discloses similar gases as those of the claimed invention, then using Shibata's gases in the same manner as claimed by Applicants would result the same in a mixture for etching a dielectric material in a layered substrate comprising: a fluorocarbon and a fluorotrioxide.

Furthermore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to employ any combination of etchant components as taught in the reference of Shibata including Applicants' specifically claimed etchant mixture because such combination of etchant mixture is known to effectively accomplish the disclosed composition in manufacturing semiconductor devices [0001].

Shibata further differs in failing to teach wherein a ratio by volume of the fluorine-containing oxidizer to the fluorocarbon is from 0.1:1 to 20:1; 0.1:1 to 10:1; and 0.1:1 to 5:1, respectively **in claims 1, 28, and 29.**

However, Shibata illustrates the specific combination of a fluorocarbon and fluorine-containing oxidizer is known. As a result, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select any proportion (% by volume) fluorocarbon in the Shibata reference because such combination is known to effectively accomplish the disclosed composition by using a small amount of gas to efficiently remove by-products such as SiO_2 and Si_3N_4 [0021].

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shibata (US '757 A1) as applied to claim 1 above, and further in view of Arleo et al. (US 5,176,790).

Shibata differs in failing to teach and wherein the mixture comprises from 0.1 to 99 % by volume of the inert diluent gas.

Arleo teaches etching mixtures comprising inert gases such as helium, neon, argon, krypton or xenon (column 3, lines 53-55) and may vary from 0 to 90 volume % of the total amount of gases in the mixture (column 4, lines 55-59).

Arleo illustrates inert gases in etching mixtures are known. Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Shibata by selecting any of the known inert gases in the Arleo reference for the purpose of diluting fluorine-containing gases to aid in etching an insulation layer that would result in improving the formation of via to be substantially without a taper (see Arleo, column 4, lines 62-64).

Art Unit: 1765

6. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable Shibata (US '757 A1) as applied to claim 1 above, and further in view of Liu et al. (US 6,403,491 B1).

Shibata differs in failing to teach the perfluorocarbon is hexafluoro-1,3-butadiene.

Liu teaches etching a dielectric layer using hexafluoro-1,3-butadiene (claims 1 and 24) and illustrates the said perfluorocarbon is known.

Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Shibata by employing Liu's hexafluoro-1, 3-butadiene because such a fluorocarbon compound is known to be included in etching gases for the purpose making via, self aligned contacts, dual damascene, and other dielectric etch (Liu, Abstract).

7. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shibata (US '757 A1) as applied to claim 1 above, and further in view of Misra (US 6,242,359 B1).

Shibata differs in failing to teach wherein the fluorocarbon is at least one oxyhydrofluorocarbon, **in claim 9**; and wherein the oxyhydrofluorocarbon is at least one selected from the group consisting of perfluorocyclopentene oxide, hexafluorocyclobutanone, hexafluorodihydrofuran, hexafluorobutadiene epoxide, tetrafluorocyclobutanedione perfluorotetrahydrofuran, hexafluoropropylene oxide, perfluoromethylvinyl ether, and combinations thereof, **in claim 10**.

Misra teaches etching dielectric film with hexafluoropropene oxide (same as applicants' oxyhydrofluorocarbons) compounds (column 3, line 65 – column 4, line 2). Exemplary compounds useful in the etching method include, but are not limited to

Art Unit: 1765

hexafluoropropene oxide and perfluoromethylvinyl ether or combinations thereof (column 4, line 64 - column 5, line 20).

Misra illustrates etching with an oxyhydrofluorocarbon is known. Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Shibata's etchant by using use an oxyhydrofluorocarbon as taught by Misra for the purpose of providing alternative to the conventionally used global-warming compounds for semiconductor etching processes (See Misra, column 4, lines 3-6).

Response to Arguments

8. Applicant's arguments (filed 8/2/2007) with respect to claims 1-10, 17, 20, and 27-29 have been considered but are moot in view of the new ground(s) of rejection because the formerly applied references failed to address " . . . --a fluorine-containing oxidizer selected from the group consisting of: fluoroxytrifluoromethane-- . . . , as recited in (Currently Amended) Claim 1.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 571-272-1470. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1765

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Art Unit 1765

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August 11, 2007

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

